AUTO-BALANCING DEVICE WITH LONGITUDINALLY DISPOSED AND MOVABLE PLATFORM SECTIONS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 62/790,301, filed Jan. 9, 2019, entitled Self-Balancing Personal Vehicles, and having Ywanne Ying Chen as inventor.

BACKGROUND OF THE INVENTION

[0002] The prior art includes several auto-balancing transport devices. These include the Segway, developed by Kamen et al and disclosed in U.S. Pat. No. 6,302,230 (among others), the Solowheel, by Chen (U.S. Pat. No. 8,807,250) and Hovertrax, also by Chen (U.S. Pat. No. 8,738,278). The prior art also includes the Hovershoe, disclosed in U.S. patent application Ser. No. 15/338,387. These three patents and the Hovershoe application are hereby incorporated by reference as though disclosed in their entirety herein.

[0003] The above patents disclose devices that are typically ridden with a rider standing facing forward, hips towards the line of direction of travel. In a conventional skateboard, however, a rider stands sideways. For people who experienced skateboard riding as a child, it might be easier to learn to ride an auto-balancing device standing sideways than hips forward.

[0004] U.S. Pat. No. 9,101,817, issued to Doerksen, for a Self-Stabilizing Skateboard, discloses an auto-balancing device that may be ridden while standing sideways. This device (and others like it) is disadvantageous in several aspects. One is that it is difficult to turn. There is a singular wide, flat wheel, and this wheel structure makes turning very slow or gradual. Other disadvantageous aspects include that the exposed wheel is dangerous, throws rain water, and restricts foot movement.

[0005] A need thus exists for an auto-balancing transportation device that allows a rider to stand sideways yet affords sharper and more responsive turning.

SUMMARY OF THE INVENTION

[0006] Accordingly, it is an object of the present invention to overcome the shortcomings of the prior art.

[0007] It is another object of the present invention to provide an auto-balancing transportation device that affords skateboard style riding (i.e., one foot forward) and more responsive turning.

[0008] It is also an object of the present invention to provide such a device with two platform sections or components that are movable with respect to one another and that each control a drive wheel, the differential driving of the wheels achieving turning.

[0009] These and related objects of the present invention are achieved by use of an auto-balancing device with longitudinally disposed and movable platform sections as described herein.

[0010] The attainment of the foregoing and related advantages and features of the invention should be more readily apparent to those skilled in the art, after review of the following more detailed description of the invention taken together with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIGS. **1-2** are bottom and top perspective views, respectively, of one embodiment of a transportation device in accordance with the present invention.

[0012] FIGS. **3-4** illustrate another embodiment of an auto-balancing device with a longitudinally disposed platform **115** in accordance with the present invention.

[0013] FIGS. **5-6** illustrate yet another embodiment of an auto-balancing device with a longitudinally disposed platform in accordance with the present invention.

[0014] FIG. **7** is a perspective view of another embodiment of an auto-balancing device in accordance with the present invention in which the drive wheels extend through the platform.

DETAILED DESCRIPTION

[0015] Referring to FIGS. **1** and **2**, bottom and top perspective views of a first embodiment of a transportation device **10** in accordance with the present invention are respectively shown.

[0016] Device **10** preferably includes a longitudinally disposed foot platform **15** that has two foot platform sections **21**,**22**, one located on each lateral side of the platform. Below each platform section is an auto-balancing foot platform unit or module (herein "FPU") **30**,**50**. In FIG. **1**, platform section **21** is coupled to FPU **30** and platform section **22** is coupled to FPU **50**.

[0017] Each FPU preferably has a drive wheel **31**,**51** and an associated motor **32**,**52**. The motor may be a hub motor or other motor arrangement. Each FPU also preferably has a control circuit **34**,**54**, a position sensor (such as a fore-aft tilt angle sensor or gyroscopic sensor or other sensor) **35**,**55**, and a battery **36**,**56**. Alternatively, the sensor for a given FPU may be provided with the associated platform section. Regardless, the sensors are preferably configured to sense the fore-aft tilt angle of their foot platform section.

[0018] FPUs **30**,**50** are preferably configured such that the control circuit drives the drive wheel **31**,**51** towards auto-balancing the FPU based on data from the sensor **35**,**55**. Auto-balancing arrangements, including those for use in an FPU, are known in the art.

[0019] FPUs **30**,**50** are preferably coupled to one another such that the drive wheels have a common axis of rotation, though they may be otherwise arranged without departing from the present invention.

[0020] Foot platform sections **21**,**22** each have a front end A, a rear end B, and a connecting member C therebetween. The end portions may be referred to as subsections, such as **21**A,**22**A in the front and **21**B,**22**B in the rear, and the connecting members as **21**C,**22**C. As shown in FIG. **6**, a rider would typically stand with a foot on subsections **21**A,**22**A and the other on subsections **21**B,**22**B. By switching weight from heel to ball on their feet, and vice versa, the rider can change the tilt of the connecting member **21**C,**22**C relative to one another and thus achieve turning.

[0021] For example, if in FIG. **2**, connecting member **22**C is tilted forward by 1 degree and connecting member **21**C is tilted forward by 5 degrees, then there is a 4 degree differential between the connecting members and wheel **31** is driven faster than wheel **51**, turning device **10** to the right.